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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/828,188	04/09/2001	Kenneth Graham Paterson	1509-166	1046

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IP Administration
C/o Hewlett-Packard Company
3404 East Harmony Road
Mailstop 35
Fort Collins, CO 80528-9599

EXAMINER	
ABRAHAM, ESAW T	
ART UNIT	**PAPER NUMBER**
2133	6

DATE MAILED: 11/07/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

7

Office Action Summary	Application No.	Applicant(s)	
	09/828,188	PATERSON, KENNETH GRAHAM	
	Examin r	Art Unit	
	Esaw T Abraham	2133	

-- Th MAILING DATE of this communication appears on th cov r sh t with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 April 2001* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 - 31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-31* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *5* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

1. Claims **1 to 31** are presented for examination.

Priority

2. Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119(a)-(d). The certified copy has been filed in parent Application No: 00303023.6 (EPO) filed on 04/10/2000.

Information Disclosure Statement

3. The references listed in the information disclosure statement submitted on 04/09/01 have been considered. (See attached PTO-1449).

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims **1, 5, 9, 17, 21 and 25** recite the limitation "**the roots** of the polynomial used in the said polynomial remaindering" and "**the roots** of a generator polynomial" in claims **1, 5, 9, 17, 21 and 25.** There is insufficient antecedent basis for this limitation in the claim.

5. Claims **1, 5, 9, 17, 21 and 25** are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are: It is not clear where in the

claimed method said "the roots of the polynomial used in said polynomial remaindering process are different to the roots of a generator polynomial of said Reed-Solomon error correcting code". It is not clear if the polynomial remaindering process and the Reed-Solomon error correcting code confined in the generator polynomial. The interconnection of such performance of checksum calculation with the generator polynomial can neither be visualized in the drawings nor can be clearly understood from the claimed language for proper examination purposes. The examiner would appreciate if the applicant would clarify this matter.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. Claims **1-31** are rejected under 35 U.S.C. 103(a) as being unpatentable over Tenengolts (U.S. PN: 4,782,490) in view of Lee et al. (U.S. PN: 5,872,799).

As per claims **1, 5, 16, 17 and 21,** Tenengolts substantially teach or disclose a method or system for error detection and correction in which codewords are made up of data and two groups of check symbols. The first group of check symbols is generated by a correction verification code, which verifies error correction; and, the second group of check symbols is generated by an interleaved Reed-Solomon code with symbols from the Galois field GF (2^8), which serves for error correction and the correction verification code is cyclic with a generator polynomial over the GF (2^8). The error correction system uses the first root of an error location polynomial to calculate the second root of the polynomial and the detection system, which employs a portion of the error correction system circuitry, uses a cyclic code with a generator polynomial is a root of a primitive polynomial over the GF (see abstract). Tenengolts **do not explicitly** teach a method of performing a checksum that includes a byte based polynomial remaindering. **However,** Lee et al. in an analogous art teach a check symbols that represent redundant information about the code word and used to provide error correction and detection capabilities and the check symbols are the coefficients of the remainder polynomial generated by dividing the order of polynomial by an order of "generator polynomial" over a Galois field (see col. 1, lines 46-65 and abstract). Further, Lee et al. teach a method of interleaving Reed-Solomon error correcting code word comprising the steps of receiving a plurality of data symbols; computing, in each interleave a code word including said data symbols and a plurality of check symbols, said check symbols being generated by a generator polynomial where alpha is a primitive element of GF (2^m) (see claim 1). Furthermore, Lee et al. teach a method of storing and retrieving data from a mass storage media packed in 8-bit bytes and a check symbol generator operates from the packed bytes (see col. 10, lines 40-55). **Therefore,** it would have

been obvious to a person having an ordinary skill in the art at the time the invention was made to implement the teachings of Tenengolts with the method of retrieving (reading out) data from a mass storage packed in 8-bit bytes (byte-based) and a check symbol generator operates from the packed byte as taught by Lee et al. **This modification** would have been obvious because a person having ordinary skill in the art would have been motivated to do so because it would be relatively high in operation to achieve a reduction in power consumption and an increase in speed of decoding operation.

As per claims **2, 6, 18 and 22,** Tenengolts in view of Lee et al. teach all the subject matter claimed in claims 1, 5, 17 and 21 including Tenengolts teaches first group of check symbols generated by a correction verification code and second group of check symbols generated by Reed-Solomon code with symbols from the Galois field GF (2^8), which serves for error correction and the correction verification code is cyclic with a generator polynomial over the GF (2^8). Further, Lee et al. teach that receiving a plurality of data symbols and a plurality of check symbols, said check symbols being generated by a generator polynomial where alpha is a primitive element of GF (2^m). Tenengolts in view of Lee et al. **do not explicitly** teach a polynomial X^2+X.alpha^2+alpha where alpha is the primitive element GF (2^8). **However,** using polynomials having different degrees is common practice for most of polynomial generators and the implementation is up to the designers' choice depending on the requirement of the system to correct/detect errors. **Therefore,** it would have been obvious to a person having an ordinary skill in the art at the time the invention was made to employ a process of using a polynomial of different degrees for defining redundancy codes. **This modification** would have been obvious

because a person having ordinary skill in the art would have been motivated in order to permit flexibility of achieving higher coding gains and lower decoding complexities.

As per claims **3, 4, 7, 8, 19, 20, 23 and 24,** Tenengolts in view of Lee et al. teach all the subject matter claimed in claims 1, 5, 17 and 21 including Lee et al. in figure 1 teach or disclose that in a storage system an error condition may exist which causes all symbols stored in the storage system to be zeroed and under that error condition, from a syndrome computation, the resulting syndrome coefficients become all zeroes, thereby *masking* the error condition (see col. 12, lines 12-20).

As per claims **9 and 25,** Tenengolts substantially teach or disclose a method or system for error detection and correction in which codewords are made up of data and two groups of check symbols. The first group of check symbols is generated by a correction verification code, which verifies error correction; and, the second group of check symbols is generated by an interleaved Reed-Solomon code with symbols from the Galois field GF (2^8), which serves for error correction and the correction verification code is cyclic with a generator polynomial over the GF (2^8). The error correction system uses the first root of an error location polynomial to calculate the second root of the polynomial and the detection system, which employs a portion of the error correction system circuitry, uses a cyclic code with a generator polynomial is a root of a primitive polynomial over the GF (see abstract). Further, Tenengolts teach that a system for correcting errors in a codeword that includes data, a first group of check symbols and a second group of check symbols, at least a portion of the first group of check symbols having been generated by a code with a generator polynomial over the Galois field GF (2^m) the second group

of check symbols having been generated from the data and the first group of check symbols as "data" by an interleaved Reed-Solomon code with a generator polynomial (see claim 25). Tenengolts **do not explicitly** teach performing a checksum includes a byte based polynomial remaindering. **However,** Lee et al. in an analogous art teach a check symbols that represent redundant information about the code word and used to provide error correction and detection capabilities and the check symbols are the coefficients of the remainder polynomial generated by dividing the order of polynomial by an order of "generator polynomial" over a Galois field (see col. 1, lines 46-65 and abstract). Further, Lee et al. teach a method of interleaving Reed-Solomon error correcting code word comprising the steps of receiving a plurality of data symbols; computing, in each interleave a code word including said data symbols and a plurality of check symbols, said check symbols being generated by a generator polynomial where alpha is a primitive element of GF (2^m) (see claim 1). Furthermore, Lee et al. teach a method of storing and retrieving data from a mass storage media packed in 8-bit bytes and a check symbol generator operates from the packed bytes (see col. 10, lines 40-55). **Therefore,** it would have been obvious to a person having an ordinary skill in the art at the time the invention was made to implement the teachings of Tenengolts with the method of retrieving (reading out) data from a mass storage packed in 8-bit bytes (byte-based) and a check symbol generator operates from the packed byte as taught by Lee et al. **This modification** would have been obvious because a person having ordinary skill in the art would have been motivated to do so because it would be relatively high in operation to achieve a reduction in power consumption and an increase in speed of decoding operation.

As per claims **10 and 26,** Tenengolts in view of Lee et al. teach all the subject matter claimed in claims 9 and 25 including Tenengolts teaches first group of check symbols generated by a correction verification code and second group of check symbols generated by Reed-Solomon code with symbols from the Galois field GF (2^8), which serves for error correction and the correction verification code is cyclic with a generator polynomial over the GF (2^8). Further, Lee et al. teach that receiving a plurality of data symbols and a plurality of check symbols, said check symbols being generated by a generator polynomial where alpha is a primitive element of GF (2^m). Tenengolts in view of Lee et al. **do not explicitly** teach a polynomial X^2+X.alpha^2+alpha where alpha is the primitive element GF (2^8). **However,** using polynomials having different degrees is common practice for most of polynomial generators and the implementation is up to the designers' choice depending on the requirement of the system to correct/detect errors. **Therefore,** it would have been obvious to a person having an ordinary skill in the art at the time the invention was made to employ a process of using a polynomial of different degrees for defining redundancy codes. **This modification** would have been obvious because a person having ordinary skill in the art would have been motivated in order to permit flexibility of achieving higher coding gains and lower decoding complexities.

As per claims **11, 12, 27 and 28,** Tenengolts in view of Lee et al. teach all the subject matter claimed in claims 9 and 25 including Lee et al. in figure 1 teach or disclose that in a storage system an error condition may exist which causes all symbols stored in the storage system to be zeroed and under that error condition, from a syndrome computation, the resulting syndrome coefficients become all zeroes, thereby ***masking*** the error condition (see col. 12, lines 12-20).

As per claims **13, 15, 29 and 31,** Tenengolts in view of Lee et al. teach all the subject matter claimed in claims 9 and 25. Tenengolts substantially teach a system for correcting errors in a codeword that includes data, a first group of check symbols and a second group of check symbols, at least a portion of the first group of check symbols having been generated by a code with a generator polynomial over the Galois field GF (2^m) the second group of check symbols having been generated from the data and the first group of check symbols as "data" by an interleaved Reed-Solomon code with a generator polynomial (see claim 25). Tenengolts in view of Lee et al. **do not explicitly** teach check sum calculations operate mis-correct error 1 in 2^{16}. **However,** the technique of operating performing a check to operate mis-correct errors of any proportion (such as 1 in 2^{16} or any value) is up to the designer's choice depending the systems' requirement. **Therefore,** it would have been obvious to one of ordinary skill in the art at the time the invention was made to design or implement the size of checksum for detecting mis-correct errors. **This motivation** would have been obvious to one ordinary skill in the art at the time the invention was made because one of ordinary skill in the art would have employed a process of detecting mis-correct errors in order to improve the information bit rate and the efficiency of the system.

As per claims **14 and 30,** Tenengolts in view of Lee et al. teach all the subject matter claimed in claims 9 and 25. Tenengolts substantially teach that an error detection code employed for a high data transfer rate, a basic polynomial of an interleaved Reed-Solomon code employed having a minimal number of nonzero coefficients and a generator polynomial of the code have a form and be irreducible over the Galois field GF (2^m) then a shift register for the encoding, a combinatorial circuit for multiplication and an encoder results for the generalized Hamming

code, which corrects single symbol or detects double symbol errors (see col. 15, lines 60-67 and col. 16, lines 1-67).

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

US PN: 4,413,339 Riggle et al.

US PN: 5,822,337 Zook et al.

8. Any inquiry concerning this communication or earlier communication from the examiner should be directed to Esaw Abraham whose telephone number is (703) 305-7743. The examiner can normally be reached on M-F 8-5.

If attempts to reach the examiner by telephone are successful, the examiner's supervisor, Albert DeCady can be reached on (703) 305-9595. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 746-7239 for regular communications and (703) 746-7238 for after final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3900.

Esaw Abraham
Esaw Abraham

Art unit: 2133

Guy J. Lamarre for
Albert DeCady
Primary Examiner